



The impact of extreme flooding events and anthropogenic stressors on the macrobenthic communities' dynamics

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Abstract:

Marine and coastal environments are among the most ecologically and socio-economically important habitats on Earth. However, climate change associated with a variety of anthropogenic stressors (e.g. eutrophication) may interact to produce combined impacts on biodiversity and ecosystem functioning, which in turn will have profound implications for marine ecosystems and the economic and social systems that depend upon them. Over period 1980-2000, the environment of the Mondego estuary, Portugal, has deteriorated through eutrophication, manifested in the replacement of seagrasses by opportunistic macroalgae, degradation of water quality and increased turbidity, and the system has also experienced extreme flood events. A restoration plan was implemented in 1998 which aimed to reverse the eutrophication effects, especially to restore the original natural seagrass (*Zostera noltii*) community. This paper explores the interactions between extreme weather events (e.g. intense floods) and anthropogenic stressors (e.g. eutrophication) on the dynamics of the macrobenthic assemblages and the socio-economic implications that follow. We found that during the previous decade, the intensification of extreme flooding events had significant effects on the structure and functioning of macrobenthic communities, specifically a decline in total biomass, a decline in species richness and a decline in suspension feeders. However, the earlier eutrophication process also strongly modified the macrobenthic community, seen as a decline in species richness, increase in detritivores and a decline in herbivores together with a significant increase in small deposit-feeding polychaetes. After the implementation of the management plan, macrobenthic assemblages seemed to be recovering from eutrophication, but it is argued here that those earlier impacts reduced system stability and the resilience of the macrobenthic assemblages, so that its ability to cope with other stressors was compromised. Thus, heavy flooding in the Mondego region during the recovery process had more severe effects on these assemblages than expected, effectively re-setting the recovery clock, with significant socio-economic impacts (e.g. high mortality of fish in fish farms, and a large decline of economically important species, such as the bivalves *Scrobicularia plana* and *Cerastoderma edule*). The frequency and magnitude of these extreme events is predicted to increase in future years [IPCC WGI, 2001. Climate change 2001: the scientific basis, contribution of working group I to the third assessment report of the Intergovernmental Panel on Climate Change (IPCC). In: Houghton, J.T., Ding, Y., Griggs, D.J., Noguer, M., van der Linden, P.J., Xiaosu, D. (Eds.), Cambridge University Press, UK, 944 p.] and there is a risk that impacted ecosystems will never recover fully, with far-reaching consequences for human well being.

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Resource Description

Exposure : ☒

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weather or climate related pathway by which climate change affects health

Ecosystem Changes, Extreme Weather Event

Extreme Weather Event: Flooding

Geographic Feature:

resource focuses on specific type of geography

Ocean/Coastal

Geographic Location:

resource focuses on specific location

Non-United States

Non-United States: Europe

European Region/Country: European Country

Other European Country : Portugal

Health Impact:

specification of health effect or disease related to climate change exposure

Mental Health/Stress, Other Health Impact

Other Health Impact: well-being

Intervention:

strategy to prepare for or reduce the impact of climate change on health

A focus of content

Mitigation/Adaptation:

mitigation or adaptation strategy is a focus of resource

Adaptation

Other Projection Model/Methodology: Discussion only

Resource Type:

format or standard characteristic of resource

Research Article

Resilience:

capacity of an individual, community, or institution to dynamically and effectively respond or adapt to shifting climate impact circumstances while continuing to function

A focus of content

Timescale:

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time period studied

Time Scale Unspecified

Vulnerability/Impact Assessment:

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

A focus of content